PCT WELTORGANISATION FÜR GEISTIGES EIGENTUM
Internationales Büro
INTERNATIONALE ANMELDUNG VERÖFFENTLICHT NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

(51) **Internationale Patentklassifikation** 7 :
E21B 19/00

A2

(11) **Internationale Veröffentlichungsnummer:** **WO 00/11308**

(43) **Internationales Veröffentlichungsdatum:** 2. März 2000 (02.03.00)

(21) **Internationales Aktenzeichen:** PCT/DE99/02599

(22) **Internationales Anmeldedatum:** 19. August 1999 (19.08.99)

(30) **Prioritätsdaten:**
198 37 692.8 19. August 1998 (19.08.98) DE

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(81) **Bestimmungsstaaten:** CA, NO, US, europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

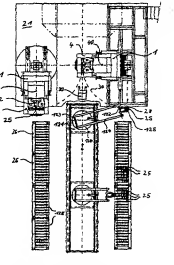
Veröffentlicht
Ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts.

(54) **Title:** DRILLING DEVICE AND METHOD FOR DRILLING A WELL

(54) **Bezeichnung:** BOHRVORRICHTUNG UND VERFAHREN ZUM ABTEUFEN EINER BOHRUNG

(57) **Abstract**

The present invention relates to a drilling device for a drilling plant, and mainly to a drilling plant that can be used in exploration and production wells mainly for hydrocarbon fields both at sea or inland. This invention also relates to a method for drilling such a well. According to the present invention, the drilling device comprises a support mechanism in or on which are mounted: a rotating head capable of axial sliding displacement relative to the longitudinal axis of the support mechanism; and a multifunctional gripper which is capable of displacement perpendicularly relative to the support mechanism, and which is used for gripping and guiding the drilling rods. The support mechanism is rigid and is preferably mounted so as to be capable of tilting movement and/or rotation. An intermediate member (27) or a pivoting crown (9) is connected to the support mechanism (1). The present invention advantageously provides a drilling device with extremely reduced dimensions which is capable of handling the rods in an autonomous manner. This invention also relates to a drilling plant characterised in that it comprises two or more drilling devices capable of displacement or rotation or tilting movement alternatively in the middle of the wellbore.



(57) **Zusammenfassung**

Die Erfindung betrifft eine Bohrvorrichtung für eine Bohranlage beziehungsweise eine Bohranlage, die für Explorations– und Förderbohrungen, insbesondere auf Kohlenwasserstoffagerstätten eingesetzt werden kann. Diese Bohrvorrichtung kann sowohl Onshore als auch Offshore eingesetzt werden. Des Weiteren betrifft diese Erfindung ein Verfahren zum Abteufen einer derartigen Bohrung. Die erfindungsgemäße Bohrvorrichtung besteht aus einer Trageinrichtung, an oder in der ein axial zur Längsachse der Trageinrichtung verschiebbarer Kraftdrehkopf, ein multifunktionaler Greifer, welcher senkrecht zur Trageinrichtung verfahrbar ist und das Bohrgestänge führt als auch greift, wobei die Trageinrichtung selbst starr, vorzugsweise schwenkbar und/oder drehbar gelagert ist. Mit der Tragvorrichtung (1) ist ein Zwischenstück (27) oder ein Drehkranz (9) verbunden. Die mit der Erfindung erzielten Vorteile bestehen insbesondere darin, dass eine Bohrvorrichtung geschaffen wird, die außergewöhnlich platzsparend ist und das Gestänge selbstständig handeln kann. Beansprucht wird ebenfalls eine Bohranlage, die dadurch gekennzeichnet ist, das zwei oder mehrere Bohrvorrichtungen angeordnet sind, die sich abwechselnd über der Bohrlochmitte bewegen oder drehen oder schwenken.

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JC08 Rec'd PCT/PTO 16 FEB 2001

FORM PTO-1390 (REV 10-94) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

DOCKET #: 3457-66PUS

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
09/763086

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/02599	**August 19, 1999**	**198 37 692.8**

TITLE OF INVENTION

Drilling Device and Method for Drilling a Well

APPLICANT(S) FOR DO/EO/US

Thorsten DIRKS and Johannes MOSS

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371
3. [x] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [x] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [x] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [x] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] has been transmitted by the International Bureau.
   c. [] is not required, as the application was filed in the United States Receiving Office (RO/US)
6. [] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [x] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [x] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [] have been transmitted by the International Bureau.
   c. [] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [] have not been made and will not be made.
8. [] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. Below concern other document(s) or information included:

11. [] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [] A **FIRST** preliminary amendment.
    [] A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. [] A substitute specification.
15. [] A change of power of attorney and/or address letter.
16. [x] Other items or information *(specify)*: PCT Publication Sheet, Int'l Preliminary Examination Report, Int'l Search Report

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/763086	INTERNATIONAL APPLICATION NO. PCT/DE99/02599	ATTORNEY'S DOCKET NUMBER 3457-66PUS

17.[x]The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
Search Report has been prepared by the EPO or JPO **$840.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482)..... **$670.00**
No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **$760.00**
Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$970.00**
International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) **$96.00**

			ENTER APPROPRIATE BASIC FEE AMOUNT =	**$**	840.00
Surcharge of **$130.00** for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				**$**	
Claims	Number Filed	Number Extra	Rate		
Total Claims	30- 20 =	10	x **$18.00**	**$**	180.00
Independent Claims	1- 3 =	0	x **$78.00**	$	
Multiple dependent claim(s) (if applicable)			+ **$260.00**	**$**	
			TOTAL OF ABOVE CALCULATIONS =	**$**	1020.00
Reduction of ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				**$**	
			SUBTOTAL =	**$**	1020.00
Processing fee of **$130.00** for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				**$**	
			TOTAL NATIONAL FEE =	**$**	1020.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				**$**	
			TOTAL FEES ENCLOSED		$1020.00
			Amount to be refunded:		**$**
			charged:		**$**

a. [x]One check(s) in the amount(s) of $ 1020 to cover the above fees is/are enclosed.
b. [] Please charge my Deposit Account No. 03-2412 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. [x]The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 03-2412. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
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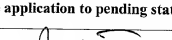
551 Fifth Avenue, Suite 1210
New York, New York 10176



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By Express Mail
No. EL727707321US

Attorney Docket #3457-66PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of

Thorsten DIRKS et al.

Int'l PCT Appln. No.: PCT/DE99/02599

Int'l Filing Date: August 19, 1999

For: Drilling Device and Method for Drilling a Well

Check box if applicable:
☐ DUPLICATE

GENERAL AUTHORIZATION FOR PAYMENT OF FEES AND PETITIONS FOR EXTENSIONS OF TIME
Submit an original and a duplicate for fee processing

Assistant Commissioner for Patents
BOX PATENT APPLICATION
Washington, DC 20231

Sir:

The Commissioner is hereby authorized to credit overpayments or charge the following fees to
Deposit Account No. 03-2412

[X] Any filing fees required under 37 CFR §1.16.
[X] Any patent application processing fees under 37 CFR §1.17 not otherwise paid by check.
[X] The issue fee set in 37 CFR 1.18 at 3 months from mailing of the Notice of Allowance, pursuant to 37 CFR 1.311 (b) provided the fee has not already been paid by check.
[X] Any filing fees under 37 CFR 1.16 for presentation of extra claims.

Respectfully submitted,
COHEN, PONTANI, LIEBERMAN & PAVANE

By _____

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Dated: February 16, 2001

By Express Mail # EL 834972625US · July 27, 2001

Attorney Docket # 3457-66PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of

Thorsten DIRKS et al.

International Appln. No.: PCT/DE99/02599

International Filing Date: August 19, 1999

For: Drilling Device and Method for Drilling a Well

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231
BOX PCT

S I R:

Applicants hereby request a three-month extension of the original shortened statutory response period set in the Notification of Missing Requirements under 35 U.S.C. 371 in the United States Designated/Elected Office of April 27, 2001. A check in the amount of $890.00 in payment of the government fee for a three-month extension of time is enclosed herewith. Any additional fees or charges required at this time in connection with the present application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Prior to examination of the above-identified application, amend the application as follows:

IN THE SPECIFICATION:

Amended page 1, line 1, delete the "Description"

Amended page 1, after line 2 and before line 3, insert centered on a separate line and on a following separate line at the left side the following heading and sub-heading:

--BACKGROUND OF THE INVENTION

1. Field of the Invention--

Amended page 1, after line 8 and before line 9, insert at the left side the sub-heading:

-- 2. Description of the related Art--

Amended page 1, delete the paragraph beginning on line 24, an substitute with the following:

U.S. Patent No. 5,018,588 describes a tie rod drill for the insertion of ground tie rods, such as are used in the civil engineering industry to secure embankments or pillar walls. The tie rod drill disclosed has a tracklaying gear on which a drill upper part is mounted by means of a live ring. Arranged on this upper part is a mast, to which a slide is fastened, on which in turn drill mount is mounted via a pivot device and a hydraulic cylinder. This drill mount consists of a supporting frame, a drill drive and two grippers, in which a drilling pipe can be retained.

Amended page 2, after line 14 and before line 15, insert centered on a separate line the following heading:

--SUMMARY OF THE INVENTION--

Amended page 2, delete the paragraph beginning on line 15, and substitute

--It is an object of the present invention to propose a drilling machine for exploratory and productive wells, a drilling rig and a method whereby decisive cost savings can be achieved with regard to logistical and personnel costs.--

Page 7, delete the paragraph beginning on line 26, and substitute:

--The text that follows provides details of a specific embodiment of the invention.--

Page 8, delete the paragraph beginning on line 11, and substitute:

--A further embodiment envisages installing a small winch in the lower region of the base in order also to pull down the receiving frame of the top drive, especially if the installation of a drawworks as a linear drive is intended. The cable of this small winch is fixed to the lower part of the receiving frame or guided downward over a return roller fixed on the receiving frame and secured. By means of this winch, workover tasks, drilling operations and also snubbing operations (or pipe installation) can be performed more simply.--

Page 9, delete the paragraph beginning on line 1, and substitute:

--Also described is a drilling rig, which is characterized in that two or more drilling machines are arranged to be alternately movable or rotatable or pivotable over the well center. The advantage of such a design resides in the fact that one drilling machine performs the actual drilling operation and the other is supplied with a pipework for that operation. As a result of this the drilling time is reduced and cost-effectiveness optimized.--

Page 10, delete the paragraph beginning on line 5, and substitute:

--The top drive is in the upper position and the multifunctional gripper at the same height as the pipes, for example, lie on the stands. The pipe is rolled over the base. Then, in the lying position, the pipe is gripped by the multifunctional gripper and thus locked. Subsequently, by means of the top drive and the handling device, which is located between the top drive and a lower region of the base, the upper connection to the pipe is produced. Subsequently, the base is raised into the vertical position by means of the lifting apparatus and the lower connection between the pipe on the base and the pipe located in the well is made. Optionally, when this position is reached, the base can be locked on a steel structure.--

Page 10, delete the paragraph beginning on line 23, and substitute:

--The connection between the top drive shaft and pipe is produced, in particular, when pipes are set down during drilling. During handling pipe steps involved in installation

and removal operations, the pipe can also be merely suspended in the elevator which is arranged below the top drive, since the thread of the pipe is particularly protected from damage and the operations can be performed more quickly.--

Page 11, delete the paragraph beginning on line 21, and substitute:

--A further advantageous embodiment of the method according to the invention is illustrated by means of a rigid base. The pipe is removed from the pipe rack by means of the rail-borne pipe handling system and moved toward the rig floor. The top drive is located in the upper position.--

Page 13, delete the paragraph beginning on line 28, and substitute:

--Examples of embodiments of the rigid version with one drilling machine and a rail-borne pipe handling system and the rotatable version with two drilling machines and pipe handling system (e.g., a vertical pipe handler/horizontal pipe handler) are explained hereinafter.--

Page 14, before line 1, centered on a separate line insert the following heading:

--BRIEF DESCRIPTION OF THE DRAWINGS--

Page 14, delete the paragraph beginning on line 1, and substitute:

--In the drawings:

Fig. 1 shows the lateral view of the base;

Fig. 2 shows the front view of a base;

Fig. 3 shows on enlarged scale the plan view of the upper part of a rotatable base;

Fig. 4 shows the lateral view of a drilling machine with a base (rigid) arrangement;

Fig. 5 shows the front view of the drilling rig;

Fig. 6 shows the plan view of a rigid drilling machine;

Fig. 7 shows a rail-borne pipe handling device (for horizontal or vertical racks);

Fig. 8 shows a frontal view of a drilling machine and a pipe handling device and a pipe receiving unit disposed alongside the drilling rig;

Fig. 9 shows the plan view of a drilling rig with two drilling machines; and

Fig. 10 shows a lateral view with two drilling machines with live rings.--

Page 14, after line 17 and before line 18, insert centered on a separate line the following heading:

--DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS--

Page 14, delete the paragraph beginning on line 18 and substitute:

--In Figs. 1, 2, 4, 5, 6, 8, 9 and 10, the receiving frame 4 with top drive 2 and handling device 5 or the pipe handling device 23 are shown in two different positions, one

position in each case being shown in broken lines. In the broken-line illustration of the receiving frame and the top drive, the return roller 11 is not shown.--

Page 14, delete the paragraph beginning on line 25 and bridging over to page 15, line 8, and substitute:

--Fig. 1 shows the lateral view of the base 1 with the top drive 2, the linear guide 3 attached to the base, the receiving frame 4 for the top drive, the handling device below the top drive 5 and the elevator for pipe acceptance. Below the top drive is optionally arranged a screwing and securing device, in order to screw a pipe feef in by means of the handling device fixedly to the shaft of the top drive, or, for example during the removal of the pipe, to break the connection again between top drive and pipe. Struts 42 of the base 1 are indicated, these improving the statics of the base.--

Page 15, delete the paragraph beginning on line 40, and substitute:

--Fig. 2 shows the frontal view of the base 1 with the top drive 2, the receiving frame 4, the handling device 5 and the elevator 6.--

Page 16, delete the paragraph beginning on line 12, and substitute:

--Fig. 3 shows the plan view of a rotatable base 1 with the linear guide 3, in which the receiving frame 4 is guided by means of guide rollers with the top drive 2 mounted thereon.--

Page 16, delete the paragraph beginning on line 20, and substitute:

--Fig. 4 shows the lateral view of the drilling machine with a base according to Fig. 1.--

Page 17, delete the paragraph beginning on line 18, and substitute:

--Fig. 5 shows the frontal view of the drilling rig with the base 1 corresponding to Fig. 2, the live ring 9 having been replaced by an intermediate piece 27.--

Page 17, delete the paragraph beginning on line 34, and substitute:

--Fig. 6 shows the plan view of the rigid drilling machine on the rig floor 21. In the plan view, the lateral arrangement of the iron roughneck 20 is identifiable. The pipes are removed from the vertically standing pipe boxes 26 by the rail-borne pipe handling system 23, which runs on the rails 24, and passed to the drilling machine. Any desired storage capacity can be achieved by this arrangement of the vertical pipe boxes 26.--

Page 18, delete the paragraph beginning on line 7, and substitute:

--Fig. 7 shows the rail-borne handling device 23. The possibility exists of storing a stock of pipes 25 in vertically standing (or horizontally) lying pipe boxes 26 and removing them therefrom.--

Page 18, delete the paragraph beginning on line 31, and substitute:

--Fig. 8 shows the frontal view of the drilling rig in section, with two bases 1 and the associated components, as shown in Fig. 2, one of the bases not being shown as a result of the section. This drilling rig is equipped, in this embodiment, with one live ring 9 in each case, below the base 1, in order to pivot the drilling machine alternately over the well center.--

Page 19, delete the paragraph beginning on line 4, and substitute:

--Fig. 9 shows the plan view of the drilling rig according to the invention with two drilling machines 40.--

Page 19, delete the paragraph beginning on line 20, and substitute:

--Fig. 10 shows the lateral view with the twin drilling machines 40, 41 according to Fig. 1 (pivoted outward, 41) and Fig. 2 (pivoted inward, 40) which are fixed on the two live rings 9 on the rig floor 21.--

Page 19, delete the paragraph beginning on line 24, and substitute:

--This design of the drilling rig possesses two drawworks 17 and also two cables 13, Fig. 10 showing only the drawworks and cable 13 of the drilling machine 40.--

Delete pages 20 and 21 in their entirety.

IN THE CLAIMS:

Please cancel claims 1-30, and add the following new claims;

--31. A drilling machine for exploratory and productive wells, comprising:

a base;

a top drive;

a guide for guiding a movement of the top drive codirectionally with a longitudinal axis of said base;

a gripper for at least one of gripping and guiding a drilling pipe, said gripper being moveable perpendicular to the base axis; and

a live ring connected to the base at a foot of said base.

32. A drilling machine according to claim 31, wherein said base is movably positionable.

33. A drilling machine according to claim according to claim 31, further comprising:

a through guide on said live ring;

a cable;

a crown block on the base; and

a drawworks, said top drive being connected to said drawworks by said cable, in connection between said top drive and said drawworks said cable passing over the crown block and through said through guide.

34. A drilling machine according to claim 31, comprising means for pivoting said base carried on said live ring.

35. A drilling machine according to claim 34, wherein said means for pivoting said base includes a connecting member, a pivot bearing on said connecting member, and a lifting apparatus extending between said pivot bearing and said base, said pivot bearing having a bolt passing through said connecting member.

36. A drilling machine according to claim 1 further comprising:

a winch carried at a lower region of said base;

a receiving frame carried on said base;

a return roller on the base; and

a winch cable secured to the receiving frame, between said winch and said receiving frame, the winch cable passing over the return roller.

37. A drilling machine according to 36, further comprising a drive unit for driving said winch.

38. A drilling machine according to claim 37, wherein said drive unit including an electric motor and a downstream transmission.

39. A drilling machine according to claim 31, further comprising:

a rig floor, said live ring being affixed to said rig floor;

a drawworks arranged below said rig floor, said drawworks including a cable guiding trolley; and

an iron roughneck arranged one of on said rig floor and in a lower region of said base above said rig floor, said iron roughneck being one of slidably moveably mounted and pivotably moveably mounted.

40. A drilling machine according to claim 39, further comprising at least one subframe box supporting said rig floor, said drawworks being arranged in said subframe box.

41. A drilling machine according to claim 31, further comprising:

a rig floor, said live ring being affixed to said rig floor; and

a pipe handling device arranged proximal at least one of said rig floor and said base.

42. A drilling machine according to claim 41, wherein said pipe handling device is arranged below said rig floor.

43. A drilling machine according to claim 42, wherein said pipe handling device comprises:

a truck moveable on rails;

a pipe receiving unit arranged on said truck; and

a pivot device, said pipe receiving unit being mounted to said pivot device so as to be at least one of rotatable and pivotable in a vertical plane.

44. A drilling machine according to claim 43, wherein said pipe receiving unit comprises at least one of a pipe gripper and a retaining unit.

45. A drilling machine according to claim 31, further comprising a steel structure, and a locking apparatus arranged on an upper end of said base and connectable to said steel structure.

46. A drilling machine according to claim 31, wherein said top drive is rotatable about an axis parallel to said base longitudinal axis.

47. A drilling machine according to claim 31, further comprising a hollow cylindrical drum carried on said base for storage of at least one of a flushing hose and power and control cables.

48. A drilling rig comprising at least two drilling machines, each drilling machine including:

a base;

a top drive;

a guide for guiding a movement of the top drive codirectionally with a longitudinal axis of said base;

a gripper for at least one of gripping and guiding a drilling pipe, said gripper being moveable perpendicular to the base axis; and

a live ring connected to the base at a foot of said base, each machine being moveable at least one of rotatably and pivotably for selective positioning of said machines over a center of a well.

49. A drilling rig according to claim 48, wherein said drilling machines have rig mounting positions symmetrical of the center of the well.

50. A drilling rig according to claim 48, wherein the bases of said machines are connected to one another by at least one of a kinematic chain, a cable and a chain.

51. A drilling rig according to claim 48, further comprising a steel structure arranged between said drilling machines, said drilling machines being reciprocally lockable to said steel structure and said drilling machines being connected to one another by at least one of a cable and a chain, the steel structure carrying a return roller, said at least one of a cable and a chain passing over said roller.

52. A drilling rig according to claim 51, further comprising a damping device arranged on at least one of the steel structure and said drilling machines, the damping device including at least one of a spring and a hydraulic cylinder with a choke.

53. A method for sinking a well and installing pipework with a drilling machine, said drilling machine having a base, a top drive guided for movement codirectionally with a base longitudinal axis, a gripper for gripping pipe, the gripper being moveable perpendicular to the base axis, a pipe handling device arranged between the top drive and a lower region of the base, and a lifting apparatus, said method comprising:

a) orienting the base to a horizontal pipe receiving position and the top drive at a top drive upper position and with the gripper at a height substantially the same as a selected pipe in a pipe stock;

b) rolling the selected pipe to position it at at least one of on and over the base;

c) gripping and holding the selected pipe with the gripper;

d) utilizing the top drive and handling device to effect a connection of an upper end of said selected pipe to said top drive;

e) raising the base to a vertical position with the lifting apparatus; and

f) connecting a lower end of the selected pipe to a pipe located in the well.

54. The method according to claim 53, further comprising locking said base to a steel structure after vertically positioning said base.

55. The method according to claim 53, wherein steps a) through f) are practiced in reverse order to remove a pipe from the well and place it at a pipe stock location, steps f) and d) being practiced to break a pipe connection, and step e) to lower the base to a horizontal orientation.

56. The method according to claim 55, wherein, the base is unlocked from said steel structure at least before the practice of step e).

57. A method for sinking a well and installing pipework with a drilling machine having a base, a top drive, a gripper for at least one of gripping and guiding a pipe, a handling device, and an elevator, said method comprising:

a) providing that said base is stationary;

b) selecting a pipe from a pipe stock rack with said handling device, said handling device being rail-borne so that said handling device can be moved to said base;

c) positioning an upper region of the selected pipe proximal at least one of said top drive and said elevator;

d) encompassing an upper region of said selected pipe with said elevator and a selected pipe lower region with said gripper;

e) screwing a drive shaft of said top drive to an upper end of the selected pipe; and

f) lowering the selected pipe to locate a lower end thereof at a machine iron roughneck and then connecting said lower end to a pipe located in said well.

58. A method for sinking a well and installing pipe work with a drilling machine, said drilling machine having a base, a top drive on the base, a handling device on the base, a gripper in the base for gripping a pipe, an elevator, and a rail-borne pipe handling unit, said method comprising:

a) providing that at least a part of the base is rotatable about a vertical axis, said top drive being located in at least one of an upper and a middle region of said base;

b) rotating said at least a part of the base to a base position proximal a pipe collection point at which a pipe selected from a pipe stock and conveyed to said collection point with said handling unit is held;

c) lowering the top drive and handling device connected thereto, and the elevator on the base sufficiently to enable said elevator to encompass said selected pipe;

d) extending the gripper from the base sufficiently for the gripper to encompass said selected pipe;

e) lifting the pipe on the base and rotating the base to position the pipe over the well; and

f) connecting a lower end of the selected pipe to a pipe located in the well, and connecting an upper end of the selected pipe to a drive shaft of said top drive.

59. The method according to claim 53, wherein connection of the upper end of said selected pipe is with a drive shaft of said top drive and is effected with at least one of a screwing and securing device, and the pipe handling device.

60. The method according to claim 58, wherein connection of the upper end of said selected pipe and said drive shaft of the top drive is effected with at least one of a screwing and securing device, and the pipe handling device.

61. The method according to claim 58, wherein the at least a part of the base which is rotatable is the top drive, said top drive being rotated about a vertical axis parallel to a longitudinal axis of said base to position it proximal said collection point.

62. The method according to claim 59, wherein connection of the lower end of the selected pipe with a pipe in the well is effected first, and then connection of the upper end of said selected pipe made with the drive shaft of said top drive.

63. The method according to claim 58, wherein during pipe handling steps involved in installation and removal operations, the selected pipe is suspended only in the elevator, connection of said selected pipe with the drive shaft of the top drive being omitted.

After the claims, insert the accompanying separate Abstract page.

ABSTRACT OF THE DISCLOSURE

A drilling machine and drilling rig for exploratory drillings and producing wells, include a base mounting atop drive, and a multifunctional gripper for gripping drilling pipe from a stock and to be raised on the base for eventual positions positioning at a well center, an elevator being provided below the top drive. The base can be rotatably mounted and have a live ring at a base lower end region, the base being rotated to the pipe stock location and being rotatable to a well center as well A drilling pipe upper end when raised on the base can be connected to the top drive, and an iron roughneck on a rig floor can be used to connect a pipe lower end to a pipe section in the well. Where two drilling machine are used, one can be used for actual drilling at the well center, and the second supplied with pipework for the operation.

REMARKS

Accompanying this preliminary amendment is a certified English translation of the German language specification submitted at filing. Specification amendment page and line number references are to the accompanying English text.

Amendments made to the specification are of form and grammatical nature and do not add any new matter. An Abstract of Disclosure has been added to the specification.

Claims 1-30 have been cancelled and are replaced with new claims 31-63 to eliminate claim multiple dependencies as well as to more particularly point out and distinctly claim the subjects matter applicants regard as their invention. The newly submitted claims are fully supported in the application disclosure as filed, and no new matter is contained in claims 31-63.

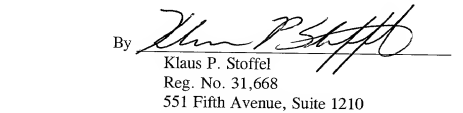
A check in the amount of $214 is enclosed in payment for the addition of new claims (2 independent claims in excess of three, 3 dependent).

An early and favorable action is solicited in this application.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,

COHEN, PONTANI, LIEBERMAN & PAVANE

By 

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July 27, 2001

MARKED UP COPY OF CHANGES TO SPECIFICATION

Amended page 1, delete the paragraph beginning on line 24, and substitute:

[US 5 018 566] U.S. Patent No. 5,018,588 describes a tie rod drill for the insertion of ground tie rods, such as are used in the civil engineering industry to secure embankments or pillar walls. The tie rod drill disclosed has a tracklaying gear on which a drill upper part is mounted by means of a live ring. Arranged on this upper part is a mast, to which a slide is fastened, on which in turn drill mount is mounted via a pivot device and a hydraulic cylinder. This drill mount consists of a supporting frame, a drill drive and two grippers, in which a drilling pipe can be retained.

Amended page 2, paragraph beginning at line 15

It is an object of the present invention to propose a drilling machine for exploratory and productive wells, a drilling rig and a method whereby decisive cost savings can be achieved with regard to logistical and personnel costs. [The object of the invention is achieved, according to the invention, by claims 1, 16, 21, 25 and 26. Further advantageous embodiments of the invention are indicated in the dependent claims]

Page 7, paragraph beginning at line 26

The text that follows provides details of a specific embodiment of the invention as illustrated in figure 4]

Page 8, paragraph beginning on line 11

A further embodiment envisages installing a small winch in the lower region of the base in order also to pull down the receiving frame of the top drive, especially if the installation of a drawworks as a linear drive is intended [as is also shown in figure1].
The cable of this small winch is fixed to the lower part of the receiving frame or guided downward over a return roller fixed on the receiving frame, and secured. By means of this winch, workover tasks, drilling operations and also snubbing operations (or pipe installation) can be performed more simply.

Page 9, paragraph beginning on line 1

Also [claimed] described is a drilling rig, which is characterized in that two or more drilling machines are arranged to be alternately movable or rotatable or pivotable over the well center. The advantage of such a design resides in the fact that one drilling machine performs the actual drilling operation and the other is supplied with a pipework for that operation. As a result of this the drilling time is reduced and cost-effectiveness optimized.

Page 10, paragraph beginning on line 5

The top drive is in the upper position and the multifunctional gripper at the same height as the pipes, for example, lie on the stands. The pipe is rolled over the base. Then, in the lying position, the pipe is gripped by the multifunctional gripper and thus locked. Subsequently,

by means of the top drive and the handling device, which is [arranged below the top drive,] located between the top drive and a lower region of the base, the upper connection to the pipe is produced. Subsequently, the base is raised into the vertical position by means of the lifting apparatus and the lower connection between the pipe on the base and the pipe located in the well is made. Optionally, when this position is reached, the base can be locked on a steel structure.

Page 10, paragraph beginning on line 23

The connection between the top drive shaft and pipe is produced, in particular, when pipes are set down during drilling. During pipe handling [pipe] steps involved in installation and removal operations, the pipe can also be merely suspended in the elevator which is arranged below the top drive, since the thread of the pipe is particularly protected from damage and the operations can be performed more quickly.

Page 11, paragraph beginning on line 21

A further advantageous embodiment of the method according to the invention is illustrated by means of a rigid base [, as illustrated for example in figure 3]. The pipe is removed from the pipe rack by means of the rail-borne pipe handling system and moved toward the rig floor. The top drive is located in the upper position.

Page 13, paragraph beginning on line 28

Examples of [embodiment] embodiments of the rigid version with one drilling machine and a rail-borne pipe handling system and the rotatable version with two drilling machines and pipe handling system (e.g., a vertical pipe handler/horizontal pipe handler [possible] are explained [in figures 1 to 10] hereinafter.

Page 14, table of drawings beginning on line 1

In the [figures] drawings:

Fig. [figure] 1 shows the lateral view of the base; [,]

Fig. [figure] 2 shows the front view of a base; [,]

Fig. [figure] 3 shows on enlarged scale the plan view of the upper part of a rotatable base; [,]

Fig. [figure] 4 shows the lateral view of a drilling machine with a base (rigid) arrangement; [,]

Fig. [figure] 5 shows the front view of the drilling rig; [,]

Fig. [figure] 6 shows the plan view of a rigid drilling machine; [,]

Fig. [figure] 7 shows a rail-borne pipe handling device (for horizontal or vertical racks); [,]

Fig. [figure] 8 shows a frontal view of a drilling [rig] machine and a pipe handling device and a pipe receiving unit disposed alongside the drilling rig; [,]

Fig. [figure] 9 shows the plan view of a drilling rig with two drilling machines; [,]and

Fig. [figure] 10 shows a lateral view with two drilling machines with live rings.

Page 14, paragraph beginning on line 18

In [figures] Figs. 1, 2, 4, 5, 6, 8, 9 and 10, the receiving frame 4 with top drive 2 and handling device 5 or the pipe handling device 23 are shown in two different positions, one position in each case being shown in broken lines. In the broken-line illustration of the receiving frame and the top drive, the return roller 11 is not shown.

Page 14, paragraph beginning on line 25 and bridging to page 15, line 8

[Figure] Fig. 1 shows the lateral view of the base 1 with the top drive 2, the linear guide 3 attached to the base, the receiving frame 4 for the top drive, the handling device below the top drive 5 and the elevator for pipe acceptance. Below the top drive is optionally arranged a screwing and securing device, in order to screw a pipe fed in by means of the handling device fixedly to the shaft of the top drive, or, for example during the removal of the pipe, to break the connection again between top drive and pipe. Struts 42 0f the base 1 are indicated, these improving the statics of the base.

Page 15, beginning on line 40

[Figure] Fig. 2 shows the frontal view of the base 1 with the top drive2, the receiving frame 4, the handling device 5 and the elevator 6.

Page 16, paragraph beginning on line 12

[Figure] Fig. 3 shows the plan view of a rotatable base 1 with the linear guide 3, in which the receiving frame 4 is guided by means of guide rollers with the top drive 2 mounted thereon.

Page 16, paragraph beginning on line 20

[Figure] Fig. 4 shows the lateral view of the drilling machine with a base according to [figure] Fig. 1.

Page 17, paragraph beginning on line 18

[Figure] Fig. 5 shows the frontal view of the drilling rig with the base 1 corresponding to [figure] Fig. 2, the live ring 9 having been replaced by an intermediate piece 27.

Page 17, paragraph beginning on line 34

[Figure] Fig. 6 shows the plan view of the rigid drilling machine on the rig floor 21. In the plan view, the lateral arrangement of the iron roughneck 20 is identifiable. The pipes are removed from the vertically standing pipe boxes 26 by the rail-borne pipe handling system 23, which runs on the rails 24, and passed to the drilling machine. Any desired storage capacity can be achieved by this arrangement of the vertical pipe boxes 26.

Page 18, paragraph beginning on line 7

[Figure] Fig. 7 shows the rail-borne handling device 23. The possibility exists of storing [the pipe] a stock of pipes 25 in vertically standing [or horizontally] (or horizontally) lying [(not shown)] pipe boxes 26 and removing them therefrom.

Page 18, paragraph beginning on line 31

[Figure] Fig. 8 shows the frontal view of the drilling rig in section, with two bases 1 and the associated components, as shown in [figure] Fig. 2, one of the bases not being shown as a result of the section. This drilling rig is equipped, in this embodiment, with one live ring 9 in each case, below the base 1, in order to pivot the drilling machine alternately over the well center.

Page 19, paragraph beginning on line 4

[Figure] Fig. 9 shows the plan view of the drilling rig according to the invention with two drilling machines 40.

Page 19, paragraph beginning on line 20

[Figure] Fig. 10 shows the lateral view with the twin drilling machines 40, 41 according to [figure] Fig. 1 (pivoted outward, 41) and [figure] Fig. 2 (pivoted inward, 40) which are fixed on the two live rings 9 on the rig floor 21.

Page 19, paragraph beginning on line 24

This design of the drilling rig possesses two drawworks 17 and also two cables 13, [figure] Fig. 10 showing only the drawworks and cable 13 of the drilling machine 40.

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MAR 12 2001

Susan Tapley

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Certificate filed in New York County and Kings County
Commission Expires July 27, 2002

Description

Drilling machine and method for sinking a well

The invention relates to a drilling machine for a drilling rig and to a drilling rig which can be used for exploratory drillings and producing wells, especially in hydrocarbon deposits. This drilling machine can be used both onshore and offshore. The invention further relates to a method for sinking such a well.

Modern drilling rigs according to the prior art consist of a large number of components, such as a drawworks, an iron roughneck, a rig floor, a pipe handling system, a pipe rack, a crown block with a traveling block and a top drive, and a pipe ramp and a catwalk for the drilling pipes and various auxiliary devices for handling.

Such drilling rigs have the disadvantage that they consist of a large number of components which, because of the constant changing of the drilling location of the drilling rigs, entail elaborate and costly logistics and large numbers of personnel. In addition, the individual components are not coordinated as regards their space requirement, so that a relatively large drilling area is needed which, however, is frequently not available (offshore) or very cost-intensive.

US 5 018 566 describes a tie rod drill for the insertion of ground tie rods, such as are used in the civil engineering industry to secure embankments or pillar walls. The tie rod drill disclosed has a tracklaying gear on which a drill upper part is mounted by means of a live ring. Arranged on this upper part is a mast, to which a slide is fastened, on which in turn

drill mount is mounted via a pivot device and a hydraulic cylinder. This drill mount consists of a supporting frame, a drill drive and two grippers, in which a drilling pipe can be retained.

The tie rod drill, like other tie rod drills (e.g. EP 0 379 187 A1) is suitable only for the placement of ground tie rods in the course of civil engineering work. These ground tie wells extend only a few meters deep into the ground or rock, and have only short pipe lengths of up to a maximum of 6 meters and pipe diameters up to a maximum of 176 mm (column 1, lines 62 to 64). For sinking exploratory and productive wells, as needed for example in the oil and natural gas industry, such tie rod drills are completely unsuitable.

It is an object of the present invention to propose a drilling machine for exploratory and productive wells, a drilling rig and a method whereby decisive cost savings can be achieved with regard to logistical and personnel costs. The object of the invention is achieved, according to the invention, by claims 1, 16, 21, 25 and 26. Further advantageous embodiments of the invention are indicated in the dependent claims.

The drilling machine for exploratory and productive wells according to the invention comprises a base, on or in which, by means of a guide, a top drive displaceable relative to the longitudinal axis of the base and a multifunctional gripper, which is movable perpendicularly relative to the base and both guides and grips the drilling pipe, are arranged, the base itself being rigid and preferably pivotably and/or rotatably mounted. An intermediate piece or a live ring is connected to the base, the intermediate piece or live ring being arranged directly at the foot of the base.

The advantages achieved by means of the invention reside especially in the fact that a drilling machine is provided which is unusually economical of space and can handle the pipe automatically. Advantageously, the

live ring connected to the base, or the intermediate piece, absorbs the forces acting on the base.

The top drive comprises the actual drive, in order to rotate the pipe, and a handling device which connects the pipe to the drive shaft of the actual drive. This handling device is located below the actual top drive. Optionally, a screwing and securing device is arranged on the top drive.

In addition, an elevator is arranged below the top drive and the handling unit and serves to lift the pipe from the vertical position.

The top drive is arranged on the receiving frame which is connected to the drawworks, for example by means of a cable, which can also be multiply rove. The receiving frame is moved, for example by means of guide rollers in a linear guide, parallel to the longitudinal axis of the base. The linear guide may be connected to the base both externally and internally.

The top drive is designed to be displaceable with the receiving frame in the linear guide. The receiving frame for the top guide may be arranged in or on the base. The guide may, for example, be

secured by a sliding rail and sliders and by racks and pinions or guide rollers and guide rails. Possible linear drives include, in addition to rack drives, spindle drives, hydraulic drives and a plurality of chain hoists. However, other linear drives resulting from technological progress could also be installed. Another possibility is a cable hoist or a block and tackle combination with a drawworks, a traveling block, a dead cable anchor, a reverse cable drum and a crown block (bearing).

Preferably, the base is formed in a box structure, for example, if it is pivotable, in a type of rocker. The foot of the base can be mounted on, in, or below the rig floor. Another possibility is for the base, including the foot, to be installed on a supporting vehicle, such as, for example, a mobile workover rig.

The ground, in other words the surface of the terrain, may also be used as a rig floor. In a particular embodiment of the invention, the rig floor of the drilling machine is connected to a subframe, which may consist of subframe boxes and/or subframe supports or other standard solutions (slingshot, etc.).

In a particularly advantageous development of the invention, the live ring of the drilling machine according to the invention has a through guide through which a cable is guided which connects the top drive via a crown block to the drawworks. Preferably, the through guide is arranged at the center of the intermediate piece or live ring, in order to ensure optimum cable guidance during the operation of the drilling machine.

A further embodiment envisages that an iron roughneck is arranged in the lower region of the base, just above the rig floor, and is used for securing and breaking.

The iron roughneck may be arranged pivotably and/or movably on the base. An alternative possibility is for the iron roughneck to be arranged movably or pivotably on the rig floor.

Advantageously, a retaining apparatus is fixed below or on the rig floor, for example in order to catch the drilling pipe or the casings.

The drilling machine may also be displaceable in a further embodiment. By displacement from the well center, the well head can be made accessible, so as to facilitate in particular the installation and removal of heavy preventers. The possibility also exists of moving the vertically standing drilling machine out of the region of the well and steering it, for example, into the region of pipe racks in order to pick up pipes. In addition, advantageously, the drilling machine can be adjusted relative to the center line. Furthermore, pipes can be taken from a plurality of pipe racks arranged side by side and, for example, positioned vertically. Moreover, this advantageous embodiment creates the possibility of moving the drilling machine from well to well among cluster wells, for example offshore.

The bases are freestanding, which means that no additional steel structure has to be fixed on the rig floor in order to stabilize the bases. However, the possibility does also exist of installing a steel structure, for example on the rig floor, as a result of which a lightweight construction of the base is permitted, since such an additional structure would increase rigidity and achieve high flexural strength. The principal forces can be passed into such a steel structure.

In such a case, a holding apparatus, preferably a locking unit, would be arranged in the upper region of this additional steel structure

and would hold both a pivotable and a rotatable base in a defined position. This locking device can be in the form of a hollow cylinder, to which a flushing hose is connected and on which a valve is arranged in order to ensure the flushing feed. The flushing is fed to the flushing hose via an ascending pipe arranged on or in the base or on the additional steel structure. Especially if the base is pivoted, it is advantageous to incorporate the flushing feed into the locking device, so that flushing is available virtually automatically and without a further working step.

As a result of the linear movement of the top drive, flexible lines must be provided for flushing, energy and the control of the ascending line to the top drive. This can be ensured, for example, by a drum arranged in the upper region of the base which, during a downward movement, unrolls the flushing hose and, during an upward movement, winds it up again so that the risk of breakage or other damage during installation and removal of pipes is avoided.

In a preferred embodiment, the top drive is arranged to be rotatable about a parallel axis of the base. As a result, only part of the drilling machine and hence a reduced load needs to be moved in order to receive a pipe. In addition, the live ring can be dispensed with. For example, the top drive is articulated by means of a hinge on a long side of the receiving frame and locked in the unrotated position, as for example during the drilling operation. The locking is released at the start of the rotating operation. The rotational movement is preferably performed by means of a hydraulic cylinder or by one or more stepping motors.

A further embodiment envisages arranging a freely suspended flushing hose on the freestanding base or on the additional steel structure.

In order to erect the supporting structure from the horizontal into the vertical position, a lifting apparatus is provided which comprises one or more hydraulic or pneumatic cylinders. Instead of a cylinder, a winch may also be used. This makes drilling possible at an angle of from 5 to 90 degrees to the surface of the terrain. Erection can also be performed in sections, with the aid of a crane, if no cylinder or winch is installed.

A particularly advantageous embodiment envisages that a winch is arranged in the lower region of the base, its cable being secured via a return roller to the receiving frame on which the top drive is located. Above the winch is the fixed roller of the cable hoist. This winch is driven by means of a drive unit, preferably comprising an electric motor with downstream transmission. Further drives, for example a hydraulic drive, are possible. As a result of this arrangement, the movement of the receiving frame and hence of the top drive in or on the base is possible, especially if little or no load has to be moved. As a result of this arrangement, the top drive can be drawn downward, in other words a compressive force toward the ground is generated.

This has the advantage that workover tasks, drilling operations and snubbing operations (e.g. pipe installation) can be carried out or initial pressure exerted at the start of drilling.

A preferred embodiment of the invention envisages that means for pivoting the base are arranged on the rig floor of the drilling machine, these means preferably comprising a pivot bearing with a bolt and a connecting member to the base, together with a lifting apparatus, if installation is not to make use of a crane.

Suitable alternative apparatuses for erecting the base include, in particular, pneumatically or hydraulically operated lifting apparatuses or winches.

A drilling machine of this design is able to sink wells at different angles or, especially with smaller drilling machines, to receive the pipe independently and actively without the need for any special pipe handling device.

A further advantageous development of the invention envisages that an independent handling device is arranged adjacent to and/or below the rig floor or adjacent to the base, and preferably comprises a truck which is arranged to be movable on rails. Arranged on the truck is a boom unit which is advantageously mounted to be rotatable and/or pivotable by means of a pivot device in a vertical plane and comprises a pipe receiving unit and/or at least one holding unit, preferably a gripper.

In the interplay between the pipe handling device (lacuna), the drilling machine can be automatically supplied with pipe in a rapid and reliable manner, especially since the pipe handling device is able to take pipes from various pipe racks, especially pipe boxes, and feed them to the drilling machine. Such an embodiment is very particularly advantageous in conjunction with a drilling rig which comprises at least two drilling machines, in which case one pipe handling device can be dispensed with.

The text that follows provides details of a specific embodiment of the invention, as illustrated in figure 4.

The drawworks is installed in one of the subframe boxes. The reserve cable drum can also be accommodated in one of these boxes. The crown block is fixed in the upper region of the base.

The cable is passed through the intermediate piece of the base in order not to interfere with the possible subsequent rotatability of the base and

to avoid damage to the cable if a live ring is retrofitted. Above the drawworks is a trolley which assists the introduction of the cable through the intermediate piece into the fulcrum of the base. By means of this arrangement, the cable is only slightly twisted and not exposed to additional stresses if a live ring is subsequently installed, for example in conjunction with a second drilling machine. A further advantage of this design is the extremely low center of gravity of such a drilling machine.

A further embodiment envisages installing a small winch in the lower region of the base in order also to pull down the receiving frame of the top drive, especially if the installation of a drawworks as a linear drive is intended, as is also shown in figure 1. The cable of this small winch is fixed to the lower part of the receiving frame or guided downward over a return roller fixed on the receiving frame, and secured. By means of this winch, workover tasks, drilling operations and also snubbing operations (or pipe installation) can be performed more simply.

A further embodiment envisages that a pipe rack is arranged adjacent to the drilling machine, and is arranged vertically for the rotatable version and horizontally for the pivotable version.

In the case of the vertical version, for example, the pipe racks stand to the right and left of and adjacent to a rail-borne pipe handling system. The pipe handling system takes the pipe from the vertical pipe racks and conveys it to a defined and fixed collection position.

A further possibility envisages that the iron roughneck is displaceable perpendicularly to the base and/or can be run into the base. The advantage of such a design resides in the fact that the downhole equipment can be introduced into the well without problems.

Also claimed is a drilling rig, which is characterized in that two or more drilling machines are arranged to be alternately movable or rotatable or pivotable over the well center. The advantage of such a design resides in the fact that one drilling machine performs the actual drilling operation and the other is supplied with pipework for that operation. As a result of this the drilling time is reduced and cost-effectiveness optimized.

Preferably, the drilling rigs are arranged substantially in exact symmetry relative to the center of the well.

Since a drilling machine which is loading a pipe is not located over the well center, the other drilling machine can connect the previously loaded pipe to the pipe drain in the well and continue sinking the well. This creates the possibility of sinking the well virtually continuously. A further advantage lies in the fact that the drilling rig can be operated with a minimum of drilling personnel, as it performs these operations almost completely automatically, especially in the handling of the pipes, etc.

Particularly when a steel structure is used, the two bases or drilling machines can advantageously be connected, preferably by means of a cable, a chain or a kinematic chain, in order to minimize the energy necessary in the pivotable version of the bases. The connection of the two supporting units is ensured via a return point, for example a roller, which is arranged in the upper region of the steel structure. With such an arrangement, the energy of the distributing supporting unit can be utilized to erect the other supporting unit. In such an embodiment, preferably, a damping device is installed on the upper steel structure in order to avoid possible resonance vibrations which may be passed into the drilling rig. Such a damping unit could, for example, comprise a spring or a hydraulic cylinder with choke.

The method according to the invention is characterized in that, in the pivotable version, the base is available in the horizontal position to receive the pipes.

The top drive is in the upper position and the multifunctional gripper at the same height as the pipes, for example, lie on the stands. The pipe is rolled over the base. Then, in the lying position, the pipe is gripped by the multifunctional gripper and thus locked. Subsequently, by means of the top drive and the handling device, which is arranged below the top drive, the upper connection to the pipe is produced. Subsequently, the base is raised into the vertical position by means of the lifting apparatus and the lower connection between the pipe on the base and the pipe located in the well is made. Optionally, when this position is reached, the base can be locked on a steel structure.

As already mentioned, the possibility exists of the base being freestanding, in which case locking or the retention of the base takes place in the region of the fulcrum or pivot point.

The connection between top drive shaft and pipe is produced, in particular, when pipes are set down during drilling. During pipe installation and removal operations, the pipe can also be merely suspended in the elevator which is arranged below the top drive, since the thread of the pipe is particularly protected from damage and the operations can be performed more quickly.

The lower pipe connection is ensured by the iron roughneck, standing on the rig floor or integrated on the base, which, to this end, either moves out from the base beyond the well center or is pivoted over the well center by means of a hinge. A further embodiment envisages that the iron roughneck is arranged conventionally in a displaceable manner on

the rig floor. Similarly, after the screw connection between the pipe in the well and that in the drilling machine is complete, the multifunctional gripper is released and run into the base.

The iron roughneck is then maneuvered out of the area, the holding apparatus is released and the drilling operation continues. To this end, the top drive is lowered in the guide of the base.

As a result of the use of two pivotable drilling machines, the advantageous possibility exists of a drilling machine located in the horizontal position picking up the pipe, while the other drilling machine drills. As soon as the vertically standing drilling machine has completed the drilling operation, and the top drive has thus arrived in the lower position, the horizontally lying drilling machine can be raised into the vertical position by means of the lifting apparatus. When this occurs, the top drive, in the case of the distributing drilling machine, is moved back into the upper position during this movement.

A further advantageous embodiment of the method according to the invention is possible by means of a rigid base, as illustrated for example in figure 4. The pipe is removed from the pipe rack by means of the rail-borne pipe handling system and moved toward the rig floor. The top drive is located in the upper position.

The pipe handling device inclines the pipe toward the base, and the top drive and the elevator, and also the handling system, are lowered to a level at which the elevator can encompass the pipe. When this level is reached, the elevator encompasses the pipe. Simultaneously, the multifunctional gripper moves out from the base and encompasses the pipe, so that the latter is fixed in its position but can be displaced in the vertical direction.

Subsequently, the pipe, suspended in the elevator, is raised by the linear drive, the multifunctional gripper guiding and controlling the pipe in the lower region and running it into the base in accordance with the travel covered in the linear guide. As soon as the top drive has arrived in the upper position, the upper connection between drive shaft and pipe is brought about with the aid of the handling device or by a screwing and securing device. Subsequently, the pipe is lowered and the connection to the pipe located in the well is brought about by means of the iron roughneck. The multifunctional gripper is then run in, the holding apparatus is released and the drilling operation is continued. Alternatively, the pipe, suspended in the elevator, can initially be screwed to the pipe located in the well and only subsequently connected to the top drive by means of the handling device or a screwing and securing device located on the top drive.

Another method step envisages that the pipe is conveyed by means of the rail-borne pipe handling device to the defined collection point. The base rotates about its own longitudinal axis with the aid of the built-in live ring and stops precisely above the collection point. At this time, the top drive is located in the upper position of the base. Alternatively, in a rigid drilling machine, it is possible for only the top drive to be pivoted or rotated from the receiving frame to a defined collection point.

The top drive, and hence also the handling device and the elevator, are now lowered. The elevator is pivoted outwards during lowering. As soon as the elevator can encompass the pipe, the latter is pivoted in and encompasses the pipe.

The multifunctional gripper is run out from the base and likewise encompasses the pipe. This serves to retain the pipe at two points and avoid shaking in the event of further handling.

Subsequently, the pipe is raised parallel to the linear guide by means of the upward-moving elevator until the top drive has reached the upper position. The base is then pivoted over the well center.

The upper connection between drive shaft and pipe by means of a screwing and securing device or with the aid of the handling device can take place during this lifting and rotational movement in order to optimize overall times.

Subsequently, the lower connection is made with the aid of the iron roughneck and the iron roughneck is subsequently maneuvered once again out of the region of the well center.

The multifunctional gripper is run into the base, the holding apparatus is released and the drilling operation is continued.

If two or more drilling machines are used, one drilling machine can receive a new pipe and the others drill, so that almost continuous drilling is guaranteed. Steps are taken here by means of appropriate control to prevent the rotating drilling machines from colliding. When pipes are being installed and removed (round trips), screwing to the drive shaft of the top drive is normally not necessary.

Instead of pipes, individual drilling train sections, casings, pipe strings, tubing or pipe-like articles may be used.

Examples of embodiment of the rigid version with one drilling machine and a rail-borne pipe handling system and the rotatable version with two drilling machines and pipe handling system (vertical pipe handler/horizontal pipe handler possible) are explained in figures 1 to 10.

In the figures:

Figure 1 shows the lateral view of the base,
Figure 2 shows the front view of a base,
Figure 3 shows the plan view of the upper part of a rotatable base,
Figure 4 shows the lateral view of a drilling machine with a base (rigid) arrangement,
Figure 5 shows the front view of a drilling rig,
Figure 6 shows the plan view of a rigid drilling machine,
Figure 7 shows a rail-borne pipe handling device (for horizontal or vertical racks),
Figure 8 shows a frontal view of a drilling rig,
Figure 9 shows the plan view of a drilling rig with two drilling machines, and
Figure 10 shows a lateral view with two drilling machines with live rings.

In figures 1, 2, 4, 5, 6 ,8, 9 and 10, the receiving frame 4 with top drive 2 and handling device 5 or the pipe handling device 23 are shown in two different positions, one position in each case being shown in broken lines. In the broken-line illustration of the receiving frame and the top drive, the return roller 11 is not shown.

Figure 1 shows the lateral view of the base 1 with the top drive 2, the linear guide 3 attached to the base, the receiving frame 4 for the top drive, the handling device below the top drive 5 and the elevator 6

for pipe acceptance. Below the top drive is optionally arranged a screwing and securing device, in order to screw a pipe fed in by means of the handling device fixedly to the shaft of the top drive, or, for example during the removal of the pipe, to break the connection again between top drive and pipe. Struts 42 of the base 1 are indicated, these improving the statics of the base.

Also shown in the drawing is the crown block 7, which is integrated in the upper region of the base. The cable 13 is guided through the live ring 9 by means of the through guide 8, in order that the position of the cable should not change during the rotational movement.

The live ring 9 is mounted below the base 1 and is fixedly connected to the rig floor.

In order to perform snubbing operations, including for example the installation of pipes, a winch 10 is installed in the lower region of the base 1. The cable (not shown) of this winch is, in this case, passed over a return roller 11 in order to utilize the cable hoist effect.

The multifunctional gripper 12 is shown in the drawing as a further structural group, this gripping and guiding the pipe and being horizontally displaceable.

In order to enable the flushing feed, the flushing hose 15 is indicated and, in this example, hangs partly free.

Arranged on the live ring is a connecting member 105 on which a rigid retaining member, in this case a strut 103, is attached by means of pillow blocks 104 and bolts. The other end of the strut 103 is fixedly connected to one side of the base 1. A further connecting member 110 contains a further pillow block 104 and provides a connection to the base 1 by means of a bolt. As a result, the entire base can be held vertically. Other connecting members whereby the base 1 can be held are of course conceivable.

Figure 2 shows the frontal view of the base 1 with the top drive 2, the receiving frame 4, the handling device 5 and the elevator 6.

The crown block 7 is additionally indicated here. At the center of the base 1 can be seen the cable 13, which is passed by the through guide 8 through the live ring 9 in the lower region.

The flushing hose (shown in figure 1 but not here) is connected to the pipe connection 16 in order to pass the flushing into the top drive.

For snubbing or pipe installation, the winch 10 is mounted in the lower part of the base 1 and is driven, for example, by an electric motor with downstream transmission (drive unit 14).

Figure 3 shows the plan view of a rotatable base 1 with the linear guide 3, in which the receiving frame 4 is guided by means of guide rollers with the top drive 2 mounted thereon.

The quarter-circular broken line represents the pivot line 30 for this arrangement as far as a fictitious collection point 28. The drive shaft 45 is only indicated, as is the lining 43 of the top drive.

Figure 4 shows the lateral view of the drilling machine with a base according to figure 1.

In this version of a non-rotatable drilling machine, the live ring is not needed. However, in order to enable rigging to take place in a simple manner, an intermediate piece 27 replacing the live ring is used, preferably having the same dimensions and connecting measures as the actual live ring, and similarly containing the through guide 8.

To this end, the rig floor 21, which serves to receive the intermediate piece 27 and also the subframe boxes 19 and the support 22, which serves to support the rig floor, are drawn in.

In addition, the drawworks 17, which can be installed in either the upper or the lower subframe box, is shown.

The cable 13 is always forcibly guided over the Lebus groove of the drawworks drum with the aid of the trolley 18.

The feeding in and collection of pipes takes place by means of the preferably rail-borne pipe handling device 23, which

can be moved on the rails 24 and transports and adjusts the pipe 25.

Also shown are the transverse struts 42, which improve the statics of the box structure of the base 1. A closed box structure may also be used instead of this lattice structure.

The pipe is removed from a pipe rack (not shown) by means of the pipe handling device 23 and passed via the rails 24 to the drilling machine. The pipe 25 is fed by means of a gripper 125 to the pipe receiving unit 122 until it can be encompassed by the elevator 6, which moves downward into the appropriate position. The pipe ramp 126 is optionally provided to secure the lower part of the pipe. A pivot device by which the boom 124 can be moved into a vertical plane is designated 123. The blow-out preventer (BOP) stack, above the well 130 (not shown), is designated 129.

Figure 5 shows the frontal view of the drilling rig with the base 1 corresponding to figure 2, the live ring 9 having been replaced by an intermediate piece 27.

This view shows, by way of example, the iron roughneck 20, which has been mounted in this form on the rig floor 21. Also shown is the top drive 2 with the handling device 5 lying below it.

The cable 13 is always forcibly guided over the Lebus groove of the drawworks 17 by means of the trolley 18, so that the cable 13 is reliably passed from this device through the through guide 8 to the crown block 7.

The base 1 is connected by the intermediate piece 27 to the rig floor 21. A driller's cabin 127 arranged on the rig floor 21 is also indicated therein.

Figure 6 shows the plan view of the rigid drilling machine on the rig floor 21. In the plan view, the lateral arrangement of the iron roughneck

20 is identifiable. The pipes are removed from the vertically standing pipe boxes 26 by the rail-borne pipe handling system 23, which runs on the rails 24, and passed to the drilling machine. Any desired storage capacity can be achieved by this arrangement of the vertical pipe boxes 26.

Figure 7 shows the rail-borne pipe handling device 23. The possibility exists of storing the pipe 25 in vertically standing or horizontally lying (not shown) pipe boxes 26 and removing them therefrom.

The pipes 25 are guided or fixed during transport, or during loading or unloading from the pipe boxes, by fingers or transport mountings 128. In this example of embodiment, the individual pipes 25 are removed from the boxes 26 by means of the pipe handling device 23. The pipe receiving unit 122, with two grippers 125 in this example, which can pivot in a vertical plane as a result of the pivot apparatus 123, is guided to the pipe 25 and the pipe 25 is gripped. Thereafter, the boom 124 is pivoted back. In this example, the truck 121 is moved on the rails 24 toward the drilling rig (not shown). In addition, a rotating apparatus 120 is provided whereby the boom 124 with the pipe receiving unit 122 can be rotated on the truck 121, for example in order to reach a particular collection point 28. Not illustrated is the possibility of designing the pipe receiving unit 122 to be displaceable, so that short lifting movements are possible in order to make it easier to remove the pipe 25 from the transport mounting.

Figure 8 shows the frontal view of the drilling rig in section, with two bases 1 and the associated components, as shown in figure 2, one of the bases not being shown as a result of the section. This drilling rig is equipped, in this embodiment, with one live ring 9 in each case, below the base 1, in order to pivot the drilling machine alternately over the well center.

In addition, the rail-borne pipe handling system 23 with the rails 24 is shown, this transporting the pipes to the respective collection points.

Figure 9 shows the plan view of the drilling rig according to the invention with two drilling machines 40.

In this view, one drilling machine 40 is pivoted inward over the well center 130 and is just ending the drilling process and the other drilling machine 41 is pivoted outward and stands ready, with pipe 25 loaded, to pivot over the well center 130. The iron roughneck 20 is arranged centrally, in order advantageously to break or make up the connections.

Similarly, the rail-borne pipe handling device 23 with the rails 24 is shown, as are the pipe boxes 26.

The pipes 25 are transported to the collection points 28 and taken over by the handling device 5 (not shown) with the elevator 6 (not shown) lying below it.

Figure 10 shows the lateral view with the twin drilling machines 40, 41 according to figure 1 (pivoted outward, 41) and figure 2 (pivoted inward, 40), which are fixed on the two live rings 9 on the rig floor 21.

This design of the drilling rig possesses two drawworks 17 and also two cables 13, figure 10 showing only the drawworks 17 and the cable 13 of the drilling machine 40.

In this example of embodiment, the drilling machine 40 is shown diagramatically as being optionally pivotable from the vertical into the horizontal position, 107 designating the lifting apparatus, 108 the pivot bearing and 109 the connecting member.

As a result of the doubling of the drilling machines, the possibility now exists of drilling with one machine and reloading the pipe with the other machine. As a result, the well can be sunk more quickly.

List of References

1 Base
2 Top drive
3 Linear guide
4 Receiving frame
5 Handling device
6 Elevator
7 Crown block
8 Through guide
9 Live ring
10 Winch
11 Return roller
12 Multifunctional gripper
13 Cable
14 Drive unit
15 Flushing hose
16 Pipe connection
17 Drawworks
19 Subframe boxes
20 Iron roughneck
21 Rig floor
22 Support
23 Pipe handling device
24 Rails
25 Pipe
26 Pipe boxes
27 Intermediate piece
28 Collection point
30 Pivot line
40 Drilling machine
41 Further drilling machine
42 Struts of the base 1
43 Lining of the top drive 2
44 Guide rollers in the linear guide 3
45 Drive shaft of the top drive 2

46 Fixed roller of the cable hoist, which is connected via a cable and the return roller 11 to the winch 10

102 Pipe connector

103 Rigid retaining member

104 Pillow block with bolt

105 Connecting member between retaining member 103 and live ring 9 or intermediate piece 27

107 Lifting apparatus

108 Pivot bearing with bolt

109 Connecting member between lifting apparatus 107 and live ring 9 or intermediate piece 27

110 Connecting member between base 1 and live ring 9 or intermediate piece 27

120 Rotating apparatus

121 Truck of the pipe handling device 23

122 Pipe receiving unit

123 Pivot apparatus

124 Boom of the pipe handling device 23

125 Gripper of the pipe receiving unit 122

126 Pipe ramp

127 Driller's cab

128 Fingers or transport mountings

129 BOP (blow-out preventer) stack

130 Well

Patent Claims

1. A drilling machine for exploratory and productive wells, consisting of a base (1), a top drive (2), and a gripper (12), characterized in that the top drive (2) is arranged to be displaceable by means of a guide in or directly on the base (1) axially to the longitudinal axis of the base (1), and in that the gripper (12) is arranged to be movable perpendicularly to the axis of the base (1) for gripping and/or guiding, and in that a live ring (9) is connected to the base (1), the live ring (9) being arranged directly at the foot of the base (1).

2. The drilling machine as claimed in claim 1, characterized in that the base (1) is arranged to be displaceable.

3. The drilling machine as claimed in claim 1 or 2, characterized in that the live ring (9) has a through guide (8) through which is guided a cable (13) that connects the top drive (2) via a crown bearing (7) to a drawworks (17).

4. The drilling machine as claimed in claims 1 to 3, characterized in that means for pivoting the base (1) are arranged on the live ring (9).

5. The drilling machine as claimed in claim 4, characterized in that the means comprise a pivot bearing with a bolt (108) and a connecting member (109), together with a lifting apparatus (107).

6. The drilling machine as claimed in claims 1 to 5, characterized in that a winch (10) is arranged in the lower region of the base (1), the cable of the winch (10) being secured via a deflection roller (11) to the receiving frame (4).

7. The drilling machine as claimed in claim 6, wherein the winch (10) is driven by a drive unit (14), preferably comprising an electric motor with downstream transmission.

8. The drilling machine as claimed in claims 1 to 7, characterized in that the base (1) is connected via the live ring (9) to a rig floor (21), the drawworks (17) with a boggy truck (18) being arranged below the rig floor (21) and a iron roughneck (20) being arranged on the rig floor (21) or in the lower region of the base (1) above the rig floor (21), this iron roughneck (20) preferably being of slidable or pivotable design.

9. The drilling machine as claimed in claim 8, characterized in that the drawworks (17) is arranged in at least one subframe box (19) which supports the rig floor (21).

10. The drilling machine as claimed in claims 1 to 9, characterized in that a pipe handling device (23) is arranged adjacent to and/or below the rig floor (21) or adjacent to the base (1).

11. The drilling machine as claimed in claim 10, characterized in that the pipe handling device (23) consists of a truck (121) which is arranged to be displaceable on rails (24) and in that a pipe receiving unit (122) is arranged on the truck (122) and is mounted to be rotatable and/or pivotable in a vertical plane by means of a pivot device (123).

12. The drilling machine as claimed in claim 11, characterized in that the pipe receiving unit (122) comprises a gripper seating (124) and/or a retaining unit, preferably a gripper (125).

13. The drilling machine as claimed in one of claims 1 to 12, characterized in that a locking apparatus is arranged at the upper end of the base (1) and is connected to a steel structure, preferably a tower or a mast.

14. The drilling machine as claimed in one of claims 1 to 13, characterized in that the top drive (2) is arranged to be rotatable about a parallel axis of the base.

15. The drilling apparatus as claimed in one of claims 1 to 14, characterized in that a drum is arranged on or in the base onto which the flushing hose and/or the power and control lines are rolled up.

16. A drilling rig comprising at least two drilling machines as claimed in claims 1 to 15, characterized in that the drilling rigs are arranged to be alternately movable or rotatable or pivotable over the center of a well (130).

17. The drilling rig as claimed in claim 16, characterized in that two drilling devices (40, 41) are arranged substantially symmetrically to the center of the well (130).

18. The drilling rig as claimed in claim 16 or 17, characterized in that the pivotable drilling devices are connected to one another, the connection preferably being provided by means of a serrated chain or a cable or a chain.

19. The drilling rig as claimed in one of claims 16 to 18, characterized in that a steel structure is arranged between two drilling machines, to which steel structure the drilling machines can be reciprocally locked, the drilling machines being connected by means of cable or chain via a return point or a return roller which is arranged in the steel structure.

20. The drilling rig as claimed in claim 21, characterized in that a damping device is arranged on the support devices of the drilling machines or the steel structure, the damping unit preferably consisting of a hydraulic cylinder and a choke.

21. A method for sinking a well and installing pipework by means of a drilling machine as claimed in claims 1 to 20, characterized in that

a) the base (1) is prepared in the horizontal position to receive the pipe, the top drive (2) being in the upper position and the gripper (12) at approximately the same height as the pipes (25),

b) the pipe (25) is rolled onto or over the base (1) and then

c) the pipe (25) is gripped and held by the gripper (12), and then

d) by means of the top drive (1) and the handling device (5) which is preferably arranged below the top drive, the upper connection of the top drive (2) to the pipe (25) is produced, and subsequently,

e) the base (1) is raised by means of the lifting apparatus (107) to the vertical position, and

f) the lower connection between the pipe (25) and the pipe located in the well (130) is produced.

22. The method as claimed in claim 21, characterized in that, after the base (1) has been lifted into the vertical position, it is locked in a steel structure.

23. The method as claimed in claim 21 or 22, characterized in that method steps a) to f) are carried out in reverse sequence in order to remove pipes (25) and lay them on or in a pipe rack, the release of the connection replacing the production of a connection d) and f) and the lowering of the base replacing the lifting of the base (1)(e).

24. The method as claimed in claim 23, characterized in that, when the base (1) is locked in a steel structure, the locking is released.

25. A method for sinking a well and for installing pipework by means of a drilling machine as claimed in claims 1 to 20, characterized in that

a) a stationary base (1) is used and

b) the pipe (25) is removed from a pipe rack by means of a rail-borne pipe handling device (23) and moved toward the base,

c) the upper region of the pipe (25) being brought to the top drive (1) or the elevator (6) in such a way that the elevator (6) can encompass the pipe (25), and subsequently

d) the pipe (25) is encompassed in the upper region by the elevator (6) and in the lower region by the gripper (12), and then

e) the drive shaft of the top drive (2) is secured by screwing, and

f) then lowered and the connection is produced between the pipe located in the well (130) by means of the iron roughneck (20).

26. A method for sinking a well and installing pipework by means of a drilling machine according to one of claims 1 to 20, characterized in that

a) a base (1) which can be rotated about its longitudinal axis is used, and

b) is rotated over a collection point (28), the top drive (2) being located in the upper or middle region of the base (1), while, previously or simultaneously, a pipe (25) is conveyed to the collection point (28) by means of a pipe handling device (23), the latter preferably being rail-borne, and held ready there, and then

c) the top drive (2) and the handling device (5) connected thereto and the elevator (6) are lowered until the elevator (6) can encompass the pipe (25), and then

d) the elevator (6) encompasses the pipe (25) and the gripper (12) is moved sufficiently far out from the base (1) to encompass the pipe (25) and

e) the pipe (25) is lifted and the base (1) is pivoted over the well (130), where the pipe (25)

f) is connected by means of the iron roughneck (20) to the pipe located in the well and to the drive shaft of the top drive (2).

27. The method as claimed in claims 26 or 21, characterized in that the upper connection between the drive shaft of the top drive (2) and the pipe (25) is produced by means of a screwing and securing device or by means of the handling device (5) during the lifting and rotating movement.

28. The method as claimed in claim 26 or 27, characterized in that, in step a), instead of the base (1) only the top drive (2) is rotated about a vertical axis parallel to the longitudinal axis of the base away from the well center and positioned above a collection point.

29. The method as claimed in claims 21 to 28, characterized in that, first, the connection of the pipe (25) to the pipe located in the well and then the upper connection between pipe and drive shaft of the top drive (2) is produced.

30. The method as claimed in claims 21 to 29, characterized in that, in installation and removal operations, the pipe (25) is only suspended in the elevator (6) and is not connected to the drive shaft of the top drive.

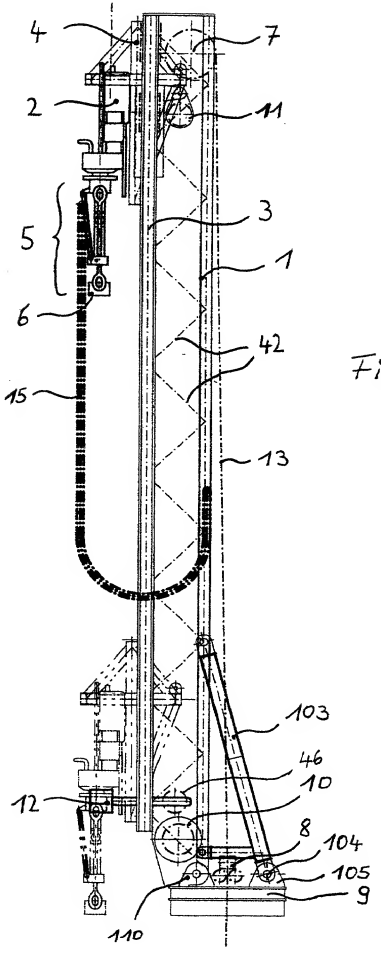

Fig. 1

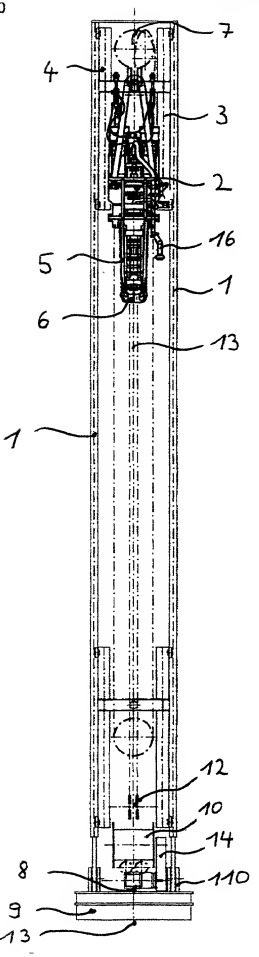

Fig. 2

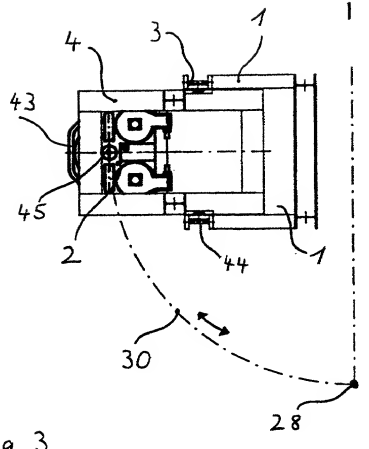

Fig. 3

Fig. 4

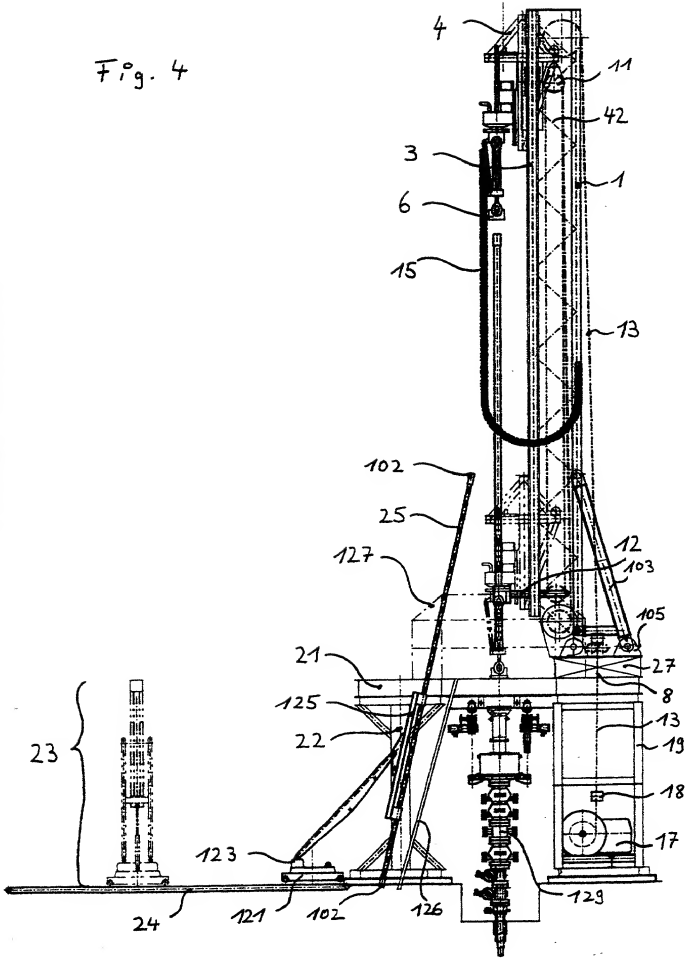
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Fig. 5

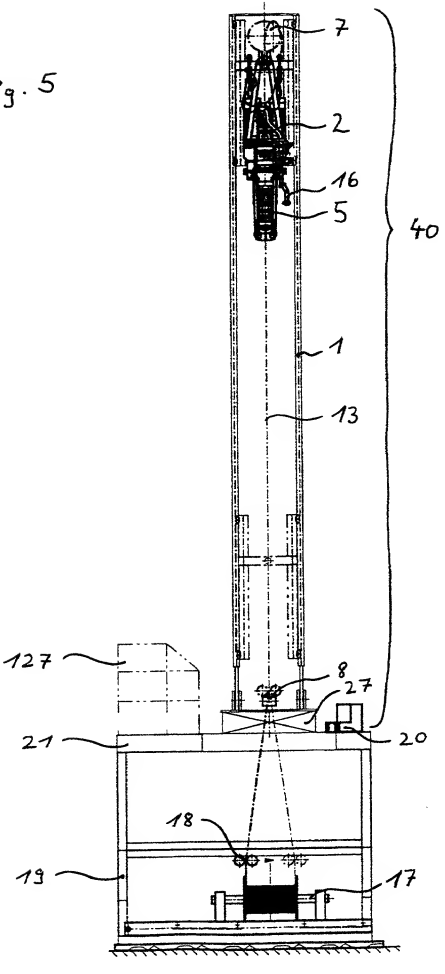
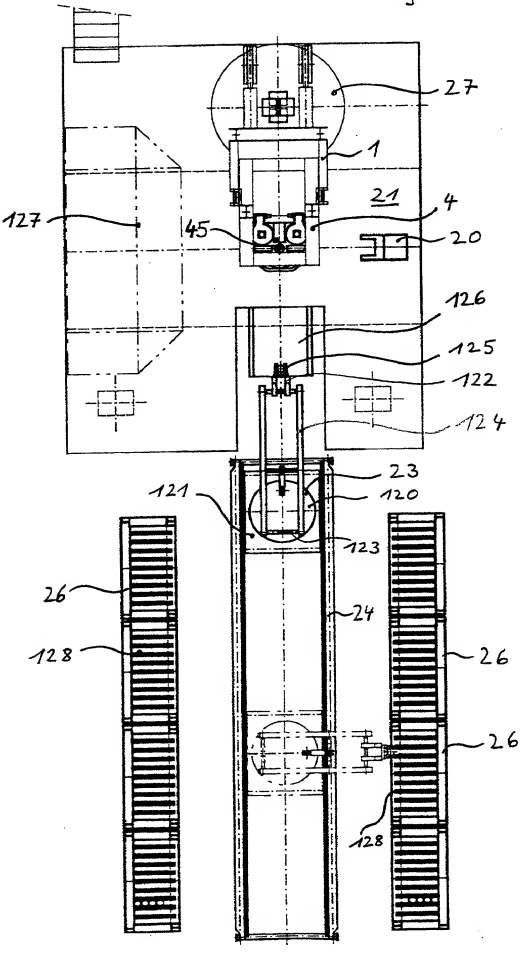


Fig. 6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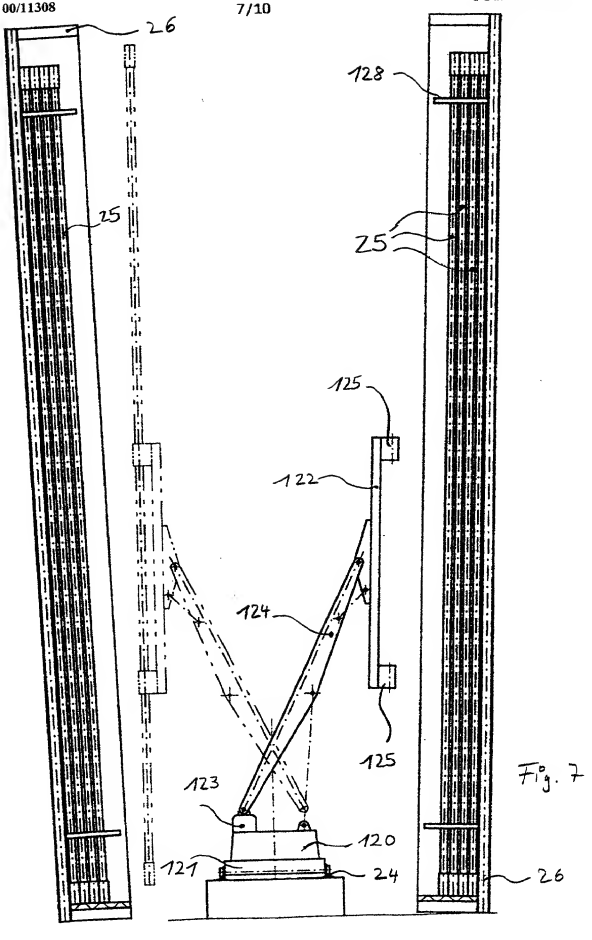
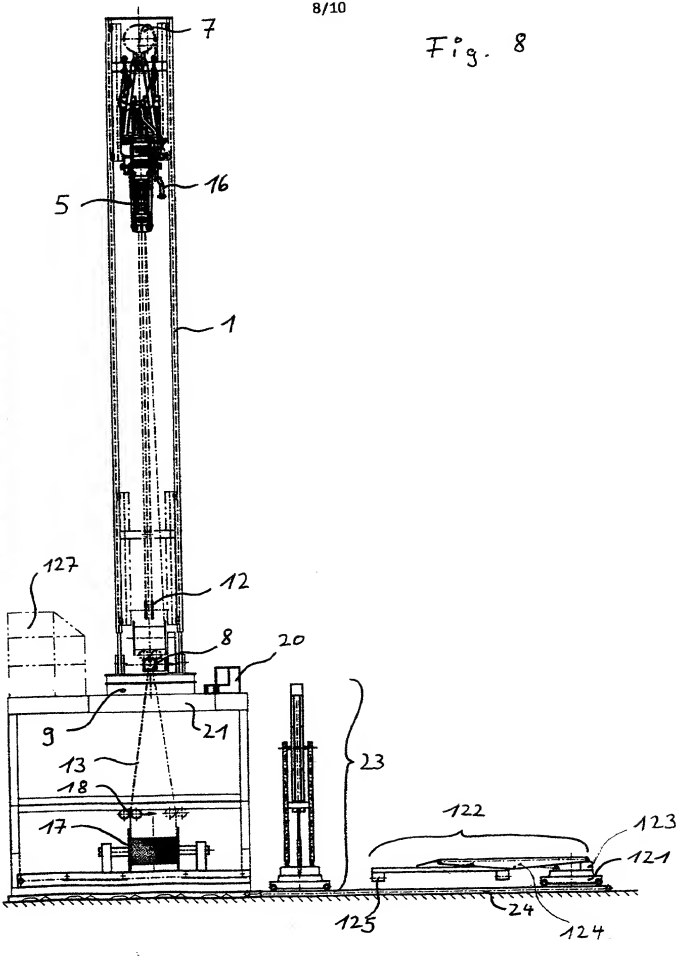


Fig. 7

Fig. 8



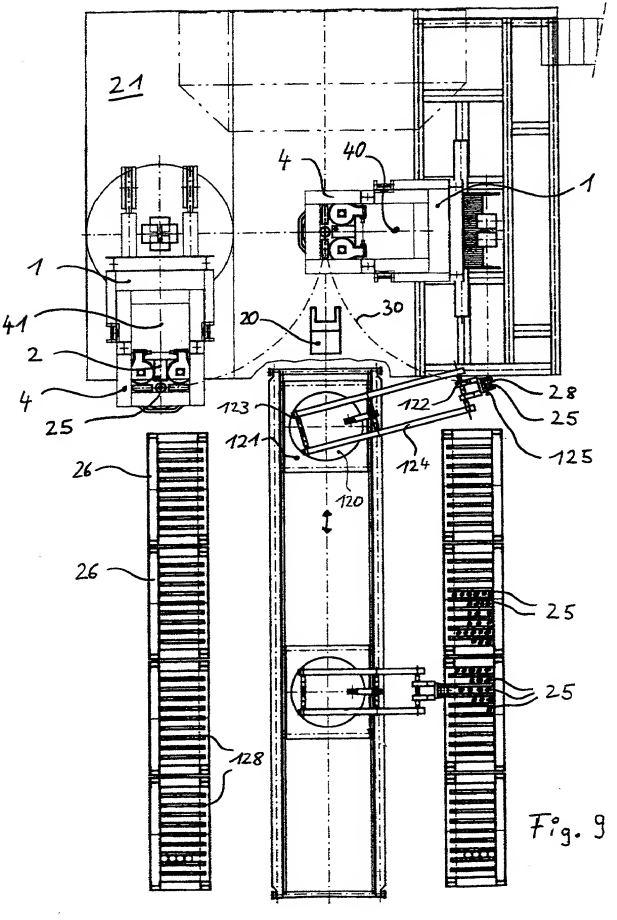

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Fig. 9

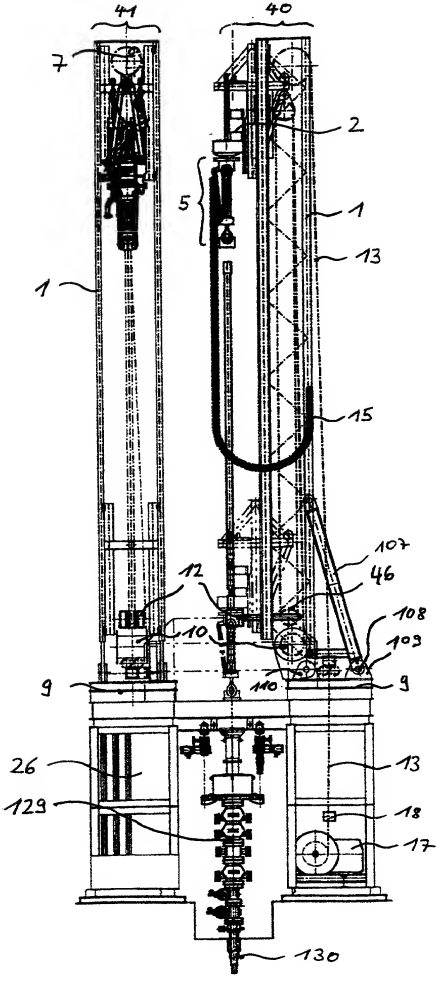

Fig. 10

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY Includes Reference to PCT International Applications	Attorney's Docket No.3457-66PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Drilling Device and Method for Drilling a Well

the specification of which (check only one item below)

[ ] is attached hereto

[ ] was filed as United States application

Serial No. _

on

and was amended

on _ (if applicable).

[x] was filed as PCT international application

Number PCT/DE99/02599

on 19 August 1999

and was amended under PCT Article 19

on (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability ofthe application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Germany	198 37 692.8	19 August 1998	[x] YES	[ ] NO
PCT	PCT/DE99/02599	19 August 1999	[x] YES	[ ] NO
			[] YES	[ ] NO
			[] YES	[ ] NO
			[] YES	[ ] NO
			[] YES	[ ] NO

Combined Declaration for Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications)

Attorney's Docket 3457-66PUS

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS *(check one)*		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED *(if any)*			
PCT/DE99/02599	19 August 1999				

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(List name and registration number)*

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Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)	Attorney's Docket 3457-66PUS

2 **0** **3**	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 2001-05-28	DATE 2001-05-28	DATE